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SMTP Service Extensions

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

1. Abstract

This memo defines a framework for extending the SMTP service by defining a means whereby a server SMTP can inform a client SMTP as to the service extensions it supports. Extensions to the SMTP service are registered with the IANA. This framework does not require modification of existing SMTP clients or servers unless the features of the service extensions are to be requested or provided.

2. Introduction

The Simple Mail Transfer Protocol (SMTP) [1] has provided a stable, effective basis for the relay function of message transfer agents. Although a decade old, SMTP has proven remarkably resilient. Nevertheless, the need for a number of protocol extensions has become evident. Rather than describing these extensions as separate and haphazard entities, this document enhances SMTP in a straightforward fashion that provides a framework in which all future extensions can be built in a single consistent way.

3. Framework for SMTP Extensions

For the purpose of service extensions to SMTP, SMTP relays a mail object containing an envelope and a content.

(1) The SMTP envelope is straightforward, and is sent as a series of SMTP protocol units: it consists of an originator address (to which error reports should be

directed); a delivery mode (e.g., deliver to recipient mailboxes); and, one or more recipient addresses.

(2) The SMTP content is sent in the SMTP DATA protocol unit and has two parts: the headers and the body. The headers form a collection of field/value pairs structured according to RFC 822 [2], whilst the body, if structured, is defined according to MIME [3]. The content is textual in nature, expressed using the US ASCII repertoire (ANSI X3.4-1986). Although extensions (such as MIME) may relax this restriction for the content body, the content headers are always encoded using the US ASCII repertoire. The algorithm defined in [4] is used to represent header values outside the US ASCII repertoire, whilst still encoding them using the US ASCII repertoire.

Although SMTP is widely and robustly deployed, some parts of the Internet community might wish to extend the SMTP service. This memo defines a means whereby both an extended SMTP client and server may recognize each other as such and the server can inform the client as to the service extensions that it supports.

It must be emphasized that any extension to the SMTP service should not be considered lightly. SMTP's strength comes primarily from its simplicity. Experience with many protocols has shown that:

protocols with few options tend towards ubiquity, whilst protocols with many options tend towards obscurity.

This means that each and every extension, regardless of its benefits, must be carefully scrutinized with respect to its implementation, deployment, and interoperability costs. In many cases, the cost of extending the SMTP service will likely outweigh the benefit.

Given this environment, the framework for the extensions described in this memo consists of:

(1) a new SMTP command (section 4)

(2) a registry of SMTP service extensions (section 5)

(3) additional parameters to the SMTP MAIL FROM and RCPT TO commands (section 6).

4. The EHLO command

A client SMTP supporting SMTP service extensions should start an SMTP session by issuing the EHLO command instead of the HELO command. If the SMTP server supports the SMTP service extensions it will give a successful response (see section 4.3), a failure response (see 4.4), or an error response (4.5). If the SMTP server does not support any SMTP service extensions it will generate an error response (see section 4.5).

4.1. Changes to STD 10, RFC 821

This specification is intended to extend STD 10, RFC 821 without impacting existing services in any way. The minor changes needed are enumerated below.

4.1.1. First command

RFC 821 states that the first command in an SMTP session must be the HELO command. This requirement is hereby amended to allow a session to start with either EHLO or HELO.

4.1.2. Maximum command line length

This specification extends the SMTP MAIL FROM and RCPT TO to allow additional parameters and parameter values. It is possible that the MAIL FROM and RCPT TO lines that result will exceed the 512 character limit on command line length imposed by RFC 821. This limit is hereby amended to only apply to command lines without any parameters. Each specification that defines new MAIL FROM or RCPT TO parameters must also specify maximum parameter value lengths for each parameter so that implementors of some set of extensions know how much buffer space must be allocated. The maximum command length that must be supported by an SMTP implementation with extensions is 512 plus the sum of all the maximum parameter lengths for all the extensions supported.

4.2. Command syntax

The syntax for this command, using the ABNF notation of [2], is:

```
ehlo-cmd ::= "EHLO" SP domain CR LF
```

If successful, the server SMTP responds with code 250. On failure, the server SMTP responds with code 550. On error, the server SMTP responds with one of codes 500, 501, 502, 504, or 421.

This command is issued instead of the HELO command, and may be issued at any time that a HELO command would be appropriate. That is, if the EHLO command is issued, and a successful response is returned, then a subsequent HELO or EHLO command will result in the server SMTP replying with code 503. A client SMTP must not cache any information returned if the EHLO command succeeds. That is, a client SMTP must issue the EHLO command at the start of each SMTP session if information about extended facilities is needed.

4.3. Successful response

If the server SMTP implements and is able to perform the EHLO command, it will return code 250. This indicates that both the server and client SMTP are in the initial state, that is, there is no transaction in progress and all state tables and buffers are cleared.

Normally, this response will be a multiline reply. Each line of the response contains a keyword and, optionally, one or more parameters. The syntax for a positive response, using the ABNF notation of [2], is:

```
ehlo-ok-rsp  ::=      "250"    domain [ SP greeting ] CR LF
               / (    "250-"   domain [ SP greeting ] CR LF
                  *( "250-"      ehlo-line           CR LF )
                     "250"    SP ehlo-line           CR LF   )

             ; the usual HELO chit-chat
greeting     ::= 1*<any character other than CR or LF>

ehlo-line    ::= ehlo-keyword *( SP ehlo-param )

ehlo-keyword ::= (ALPHA / DIGIT) *(ALPHA / DIGIT / "-")

             ; syntax and values depend on ehlo-keyword
ehlo-param   ::= 1*<any CHAR excluding SP and all
                    control characters (US ASCII 0-31
                    inclusive)>

ALPHA        ::= <any one of the 52 alphabetic characters
                  (A through Z in upper case, and,
                   a through z in lower case)>
DIGIT        ::= <any one of the 10 numeric characters
                  (0 through 9)>

CR           ::= <the carriage-return character
                  (ASCII decimal code 13)>
LF           ::= <the line-feed character
                  (ASCII decimal code 10)>
```



```
SP           ::= <the space character
                  (ASCII decimal code 32)>
```

Although EHLO keywords may be specified in upper, lower, or mixed case, they must always be recognized and processed in a case-insensitive manner. This is simply an extension of practices begun in RFC 821.

The IANA maintains a registry of SMTP service extensions. Associated with each such extension is a corresponding EHLO keyword value. Each service extension registered with the IANA must be defined in an RFC. Such RFCs must either be on the standards-track or must define an IESG-approved experimental protocol. The definition must include:

(1) the textual name of the SMTP service extension;

(2) the EHLO keyword value associated with the extension;

(3) the syntax and possible values of parameters associated with the EHLO keyword value;

(4) any additional SMTP verbs associated with the extension (additional verbs will usually be, but are not required to be, the same as the EHLO keyword value);

(5) any new parameters the extension associates with the MAIL FROM or RCPT TO verbs;

(6) how support for the extension affects the behavior of a server and client SMTP; and,

(7) the increment by which the extension is increasing the maximum length of the commands MAIL FROM, RCPT TO, or both, over that specified in RFC 821.

In addition, any EHLO keyword value that starts with an upper or lower case "X" refers to a local SMTP service extension, which is used through bilateral, rather than standardized, agreement. Keywords beginning with "X" may not be used in a registered service extension.

Any keyword values presented in the EHLO response that do not begin with "X" must correspond to a standard, standards-track, or IESG-approved experimental SMTP service extension registered with IANA. A conforming server must not offer non "X" prefixed keyword values that are not described in a registered extension.

Additional verbs are bound by the same rules as EHLO keywords; specifically, verbs begining with "X" are local extensions that may not be registered or standardized and verbs not beginning with "X" must always be registered.

4.4. Failure response

If for some reason the server SMTP is unable to list the service extensions it supports, it will return code 554.

In the case of a failure response, the client SMTP should issue either the HELO or QUIT command.

4.5. Error responses from extended servers

If the server SMTP recognizes the EHLO command, but the command argument is unacceptable, it will return code 501.

If the server SMTP recognizes, but does not implement, the EHLO command, it will return code 502.

If the server SMTP determines that the SMTP service is no longer available (e.g., due to imminent system shutdown), it will return code 421.

In the case of any error response, the client SMTP should issue either the HELO or QUIT command.

4.6. Responses from servers without extensions

A server SMTP that conforms to RFC 821 but does not support the extensions specified here will not recognize the EHLO command and will consequently return code 500, as specified in RFC 821. The server SMTP should stay in the same state after returning this code (see section 4.1.1 of RFC 821). The client SMTP may then issue either a HELO or a QUIT command.

4.7. Responses from improperly implemented servers

Some SMTP servers are known to disconnect the SMTP transmission channel upon receipt of the EHLO command. The disconnect can occur immediately or after sending a response. Such behavior violates section 4.1.1 of RFC 821, which explicitly states that disconnection should only occur after a QUIT command is issued.

Nevertheless, in order to achieve maxmimum interoperablity it is suggested that extended SMTP clients using EHLO be coded to check for server connection closure after EHLO is sent, either before or after

returning a reply. If this happens the client must decide if the operation can be successfully completed without using any SMTP extensions. If it can a new connection can be opened and the HELO command can be used.

Other improperly-implemented servers will not accept a HELO command after EHLO has been sent and rejected. In some cases, this problem can be worked around by sending a RSET after the failure response to EHLO, then sending the HELO. Clients that do this should be aware that many implementations will return a failure code (e.g., 503 Bad sequence of commands) in response to the RSET. This code can be safely ignored.

5. Initial IANA Registry

The IANA's initial registry of SMTP service extensions consists of these entries:

Service Ext	EHLO Keyword	Parameters	Verb	Added Behavior
Send	SEND	none	SEND	defined in RFC 821
Send or Mail	SOML	none	SOML	defined in RFC 821
Send and Mail	SAML	none	SAML	defined in RFC 821
Expand	EXPN	none	EXPN	defined in RFC 821
Help	HELP	none	HELP	defined in RFC 821
Turn	TURN	none	TURN	defined in RFC 821

which correspond to those SMTP commands which are defined as optional in [5]. (The mandatory SMTP commands, according to [5], are HELO, MAIL, RCPT, DATA, RSET, VRFY, NOOP, and QUIT.)

6. MAIL FROM and RCPT TO Parameters

It is recognized that several of the extensions planned for SMTP will make use of additional parameters associated with the MAIL FROM and RCPT TO command. The syntax for these commands, again using the ABNF notation of [2] as well as underlying definitions from [1], is:

```
esmtp-cmd        ::= inner-esmtp-cmd [SP esmtp-parameters] CR LF
esmtp-parameters ::= esmtp-parameter *(SP esmtp-parameter)
esmtp-parameter  ::= esmtp-keyword ["=" esmtp-value]
esmtp-keyword    ::= (ALPHA / DIGIT) *(ALPHA / DIGIT / "-")

                     ; syntax and values depend on esmtp-keyword
esmtp-value      ::= 1*<any CHAR excluding "=", SP, and all
                        control characters (US ASCII 0-31
                        inclusive)>
```

```
                        ; The following commands are extended to
                        ; accept extended parameters.
    inner-esmtp-cmd  ::= ("MAIL FROM:" reverse-path)    /
                         ("RCPT TO:" forward-path)
```

All esmtp-keyword values must be registered as part of the IANA registration process described above. This definition only provides the framework for future extension; no extended MAIL FROM or RCPT TO parameters are defined by this RFC.

6.1. Error responses

If the server SMTP does not recognize or cannot implement one or more of the parameters associated with a particular MAIL FROM or RCPT TO command, it will return code 555.

If for some reason the server is temporarily unable to accomodate one or more of the parameters associated with a MAIL FROM or RCPT TO command, and if the definition of the specific parameter does not mandate the use of another code, it should return code 455.

Errors specific to particular parameters and their values will be specified in the parameter's defining RFC.

7. Received: Header Field Annotation

SMTP servers are required to add an appropriate Received: field to the headers of all messages they receive. A "with ESMTP" clause should be added to this field when any SMTP service extensions are used. "ESMTP" is hereby added to the list of standard protocol names registered with IANA.

8. Usage Examples

(1) An interaction of the form:

```
S: <wait for connection on TCP port 25>
C: <open connection to server>
S: 220 dbc.mtview.ca.us SMTP service ready
C: EHLO ymir.claremont.edu
S: 250 dbc.mtview.ca.us says hello
 ...
```

indicates that the server SMTP implements only those SMTP commands which are defined as mandatory in [5].

(2) In contrast, an interaction of the form:

```
S: <wait for connection on TCP port 25>
C: <open connection to server>
S: 220 dbc.mtview.ca.us SMTP service ready
C: EHLO ymir.claremont.edu
S: 250-dbc.mtview.ca.us says hello
S: 250-EXPN
S: 250-HELP
S: 250-8BITMIME
S: 250-XONE
S: 250 XVRB
 ...
```

indicates that the server SMTP also implements the SMTP EXPN and HELP commands, one standard service extension (8BITMIME), and two nonstandard and unregistered service extensions (XONE and XVRB).

(3) Finally, a server that does not support SMTP service extensions would act as follows:

```
S: <wait for connection on TCP port 25>
C: <open connection to server>
S: 220 dbc.mtview.ca.us SMTP service ready
C: EHLO ymir.claremont.edu
S: 500 Command not recognized: EHLO
 ...
```

The 500 response indicates that the server SMTP does not implement the extensions specified here. The client would normally send a HELO command and proceed as specified in RFC 821. See section 4.7 for additional discussion.

9. Security Considerations

This RFC does not discuss security issues and is not believed to raise any security issues not already endemic in electronic mail and present in fully conforming implementations of RFC-821. It does provide an announcement of server mail capabilities via the response to the EHLO verb. However, all information provided by announcement of any of the initial set of service extensions defined by this RFC can be readily deduced by selective probing of the verbs required to transport and deliver mail. The security implications of service extensions described in other RFCs should be dealt with in those RFCs.

10. Acknowledgements

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Zachariassen, and the contributions of the entire IETF SMTP Working Group. Of course, none of the individuals are necessarily responsible for the combination of ideas represented here. Indeed, in some cases, the response to a particular criticism was to accept the problem identification but to include an entirely different solution from the one originally proposed.

11. References

[1] Postel, J., "Simple Mail Transfer Protocol", STD 10, RFC 821, USC/Information Sciences Institute, August 1982.

[2] Crocker, D., "Standard for the Format of ARPA Internet Text Messages", STD 11, RFC 822, UDEL, August 1982.

[3] Borenstein, N., and N. Freed, "Multipurpose Internet Mail Extensions", RFC 1521, Bellcore, Innosoft, September 1993.

[4] Moore, K., "Representation of Non-ASCII Text in Internet Message Headers", RFC 1522, University of Tennessee, September 1993.

[5] Braden, R., "Requirements for Internet Hosts - Application and Support", STD 3, RFC 1123, USC/Information Sciences Institute, October 1989.

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